[*Crown Copyright Reserved.*]

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 5.] [1913.

XXV.—GARDEN NOTES ON NEW TREES AND SHRUBS.

(With Plates.)

W. J. Bean.

XII.—A Himalayan Tree Hazel.

Corylus Jacquemontii, *Decaisne.* (*C. lacera*, Wallich, cat. No. 2798) [Corylaceae].

Owing no doubt to the great heat of the summer of 1911 and the consequent thorough ripening of the wood, the crop of hazel nuts at Kew in the autumn of 1912 was very abundant. Several trees that had never before borne fruit did so then. Amongst them was a tree received in 1898 from Messrs. Van Geert as *Corylus Colurna*. The fruit of this proved it to be the interesting tree found wild in N.W. India (Cashmere, &c.), named *C. Jacquemontii* by Decaisne and previously *C. lacera* by Wallich. Wallich's name, however, was never published, whilst Decaisne gave a full description and figure in Jacquemont, Voyage dans l'Inde, p. 160, t. 160.

C. Jacquemontii is undoubtedly very closely allied to *C. Colurna* and J. D. Hooker in the Flora of British India, vol. v., p. 625, sinks it under that species without distinguishing it as a variety, although from a note on the cover he appears to have contemplated doing so. It is distinct from the *C. Colurna* of Asia Minor, Greece and Hungary, as is shown by the drawing published herewith. The leaves are larger, being often over 6 inches long, sometimes 8 inches, and as much as 5 inches wide; the blade is not so rounded as in *C. Colurna* and more strictly obovate, the margins too are more conspicuously lobed towards the apex, the lobes more acuminate and sharply toothed. The most distinctive feature, however, is the involucre of the fruit. In *C. Colurna* this is covered densely with gland-tipped bristles, especially on the subulate lobes, which give the whole often quite a mossy aspect;

(29866—6a.) Wt. 212—780. 1125. 7/13. D & S.

in *C. Jacquemontii* the involucre is merely pubescent, the glandular bristles being absent, or few and scattered. The tree appears to be quite hardy and a vigorous grower; it breaks earlier into growth in spring than the Asia Minor tree.

In the *Kew Bulletin* for 1911, p. 327, there is a notice of the new Chinese form of *Corylus Colurna* (var. *chinensis*, Burkill; *C. chinensis*, Franchet), also a very promising hardy tree.

XIII.—New Chinese Species.

Alnus cremastogyne, *Burkill* [Betulaceae].

Judging by the photographs made by Mr. Wilson of this alder as it is found in a wild state in Western China, it forms a slender tree sometimes 80 to 100 feet high, of elegant appearance. Its leaves are obovate or oval, 2½ to 5½ inches long, 1½ to 3 inches wide, broadly cuneate or rounded at the base, acute or cuspidate at the apex, unevenly serrate, dark glossy green and glabrous above, with tufts of brown hairs in the vein-axils beneath; petiole ¼ to ½ inch long. The female strobiles are very distinct from those of other cultivated alders in being solitary on slender peduncles 1½ to 2½ inches long; they are ovoid, ¾ inch long, ⅓ inch wide, each seed having a thin, broad wing. Should the species prove hardy, as at present appears probable, its graceful aspect and distinct character will make a welcome addition to trees for damp spots in this country. It was discovered by Henry in Szechuen in 1899 and introduced by Wilson ten years later. The plants at Kew were raised from seed collected by him during his third journey.

Closely allied to it, perhaps no more than a variety, is *A. lanata*, Duthie, also introduced by Wilson. It has the same strobiles as *A. cremastogyne*, but is well marked by the dense covering of brown wool on the branchlets, petioles and peduncles, and on the underside of the leaves. No male catkins of *A. cremastogyne* are preserved at Kew, but in *A. lanata* they are slender and 2 to 3 inches long.

Berberis candidula, *C. K. Schneider* (*B. Wallichiana pallida*? Vilmorin in Frutic. Vilm. p. 15; *B. Wallichiana* var. *hypoleuca*, *Hort.*) [Berberidaceae].

Mr. Maurice de Vilmorin, in the work just cited, informs us that this charming little barberry was raised by him from seeds received from Père Farges in 1895. It has some points of resemblance to *B. Hookeri* (the *B. Wallichiana* of gardens), but certainly deserves the specific rank given it by Schneider. It is a dwarf evergreen bush of close neat habit, its branchlets stiff, spreading, and formidably armed with triple spines ½ to ¾ inch long. Leaves ¾ to 1 inch long, ⅛ to ¼ inch wide, lanceolate or linear, black polished green and smooth above, blue-white beneath, spine tipped, the larger leaves armed with one to three spiny teeth on each margin. Flowers rich golden-yellow, mostly solitary from the axils of the leaf, rather globose. Fruit black covered with blue bloom.

In gardens this new barberry will prove useful for the rock garden, being slow-growing, evergreen, and of dainty habit.

Cladrastis sinensis, *Hemsley* [Leguminosae].

If, as most authors now agree in doing, we exclude from *Cladrastis* the old genus *Maackia*, united to it by Bentham and

ALNUS CREMASTOGYNE.

[*To face page* 164.

CLADRASTIS SINENSIS.

To face page 165.]

Hooker, *C. sinensis* affords another instance of that curious isolation of a species in N.E. Asia whilst the only other known species (in this case *C. tinctoria*, the yellow wood) occurs in Eastern North America. Of this phenomenon we have examples in the two species respectively of *Sassafras*, tulip tree, *Chionanthus* and of *Gymnocladus*. That *C. sinensis* is a true *Cladrastis* as distinct from *Maackia* is shown by the leaf-buds being quite concealed by the base of the petiole and by the brittle nature of the twigs.

It is a deciduous tree 50 feet or more in height, the branchlets rusty pubescent at the base. Leaves pinnate, consisting of 11 to 17 leaflets which are oblong or ovate, 1½ to 3 inches long in cultivated trees, but up to 5 inches long and 1½ inches wide in wild specimens, pointed at the apex, cuneate or rounded at the base, dark green and smooth above, rather glaucous and pubescent on the midrib beneath; rachis and the short petiolule also pubescent. Flowers (not yet seen in gardens) blush-white, fragrant, papilionaceous, ½ inch long, borne in erect pyramidal panicles as much as 12 inches long and 9 inches wide. Calyx pubescent. Seed-pod flattened, smooth, 2 to 3 inches long, ½ inch wide.

This interesting and handsome tree appears, judging by plants at Coombe Wood and Kew, to be quite hardy. It was originally discovered by Mr. E. A. Pratt in 1890 in Szechuen, but was not introduced until 1901, when Mr. Wilson sent it home to Messrs. Veitch, to whom Kew is indebted for plants now in the collection.

Diospyros armata, *Hemsley* [Ebenaceae].

We have already in cultivation two perfectly hardy species of *Diospyros*, viz., *D. Lotus* and *D. virginiana*, and a third (*D. Kaki*) that is nearly so, for although it suffers in the open, it grows well and bears fruit on a wall. *D. armata* is an interesting addition for which we have to thank Messrs. Veitch, who have lately enabled us to add it to the Kew collection. It was originally discovered by Henry in Central China and introduced by Wilson in 1904, since when it has been grown in the Coombe Wood Nursery, and is, so far as can at present be judged, entirely hardy.

It is a deciduous shrub of very sturdy habit and slow-growing, but is described as sometimes becoming 20 feet in height; the branchlets are clothed with a close minute pubescence for the first two seasons and are occasionally terminated by a spine. Leaves oval or inclined to obovate, cuneate at the base, obtuse or rounded at the apex; 1 to 2½ inches long, ½ to 1¼ inches wide; dark green and glossy above, and glabrous on both surfaces except for pubescence on the midrib above and below. The blade is dotted with minute transparent glands; petiole ⅛ inch or less long, pubescent. Flowers unknown. Fruit globose, ¾ inch in diameter, borne on a stalk ½ inch in length, the calyx (whose four ovate lobes are ½ inch long) persisting at the base.

Mr. Hemsley described the foliage as persistent (Journ. Linn. Soc., xxvi., p. 69), but the Kew plant is quite deciduous, nor, on the solitary specimen in the Herbarium, are there any leaves except what are borne on the shoots of the year.

Enkianthus chinensis, *Franchet* [Ericaceae].

Mr. J. C. Williams of Caerhays Castle, has recently presented to Kew one of the very few examples of this *Enkianthus* at present

in cultivation. The species was originally discovered by Delavay in Yunnan, but was introduced to cultivation about 1901 by Wilson, who found it in W. Hupeh. It is a deciduous shrub 6 to 15 feet high with grey, smooth branchlets bearing the leaves in a cluster at the end. The leaves are mostly oval but vary more or less towards ovate and obovate, 1 to 2½ inches long, ½ to 1½ inches wide, tapering towards both ends, the margin set with minute, regular, incurved teeth; both surfaces glabrous; petiole ¼ to ½ inch long. The flowers appear in June, when the leaves are already fully-grown, borne on pendulous, corymbose racemes 1½ to 3 inches long, each flower on a slender, glabrous peduncle ½ to 1 inch long. Corolla campanulate, about ⅓ inch wide and long, salmon pink with deeper red lines, the 5 lobes rounded, shallow. Sepals ovate-lanceolate, glabrous, ⅛ inch long. Fruit a dry, 5-celled, subglobose capsule ¼ inch in length traversed lengthwise by 5 acute ridges.

This species is most nearly allied to *E. himalaicus*, Hook. f. and Thoms., which is, however, well distinguished by the bristly midrib (beneath) and petiole.

Meliosma Oldhami, *Miquel* [Sabiaceae].

Richard Oldham, the Kew collector, appears to have been the first to discover this species, which he did in 1863, in the Corean Archipelago. More than twenty years later Henry found it in Hupeh, and Farges in Szechuen. Wilson introduced it to the Coombe Wood nursery, whence Messrs. Veitch have kindly presented a plant to Kew. It belongs to the pinnate-leaved section of the genus and like its ally, *M. Veitchiorum*, Hemsl. and Wilson, (see *K.B.*, 1910, p. 173) is somewhat thin in branching.

A deciduous tree 50 feet high with pinnate leaves 7 to 15 inches long; leaflets 5 to 11, the terminal ones the largest; the lower ones ovate and rounded at the base, middle ones oval, terminal ones obovate and more or less cuneate at the base; all are acuminate at the apex and have small slender teeth except towards the base; there are scattered minute bristles on both surfaces and tufts of down in the vein-axils beneath; they vary in size from 1 inch long and ¾ inch wide (the lower ovate ones) to 5½ inches long and 2 inches wide (the terminal obovate ones). The inflorescence is composed of a terminal panicle supplemented by smaller panicles in the axils of the upper leaves, the whole being 8 to 10 inches wide and high. The flowers are very small (⅙ inch diameter), very numerous, probably creamy white and fragrant; peduncles and pedicels pubescent.

Osmanthus armatus, *Diels* [Oleaceae].

At present the genus *Osmanthus* is not strongly represented in the out-door garden. But to the long cultivated *O. Aquifolium* and the hybrid *O. Fortunei* (see *Kew Bulletin*, 1911, p. 177), two species have recently been added from China. One of them, *O. Delavayi*, has already been described in these notes (*K.B.*, 1910, p. 393). The present species, *O. armatus*, is very distinct from any of the above. It is an evergreen shrub or small tree up to 15 ft. high, the young shoots at first minutely downy, ultimately greyish white. Leaves hard in texture, oblong-lanceolate or narrowly oval, 3 to 6 inches long, pointed, subcordate at the base or rounded to a short, purplish petiole; margins armed with large,

unequal, triangular, spine-tipped teeth, dark dull green, prominently net-veined and glabrous on both surfaces. It flowers in autumn like *O. Aquifolium*, producing the blossoms in fascicles from the leaf-axils; they are creamy white, ¼ inch wide, and fragrant, solitary on a slender peduncle ¼ inch in length. The fruit is described as violet-black, ovoid and ¾ inch long.

All the plants in cultivation appear to have been raised from a single plant brought home in 1902 by Wilson from Western Hupeh, throughout the woods of which area the species is sparingly scattered. The collector describes it as inhabiting cliffs and humus-clad boulders either in shade or fully exposed. It has lately been obtained for the Kew collection from Messrs. Veitch. In the adult state the leaves are less formidably toothed and are even entire. It is apparently quite hardy.

Salix Bockii, *Seemen* [Salicaceae].

This is a pleasing dwarf willow of spreading habit and growing only 3 or 4 feet high, densely branched and very leafy. The slender young branchlets are covered with silky grey down and bear the leaves at intervals of ⅛ to ¼ inch. The leaves are oblong or oval, ¼ to ½ inch long, rounded at the base, mucronate at the apex, dark green and glabrescent above, silvery beneath with silky appressed hairs. The flowers open in October and November before the fall of the leaf, and the plant, especially the male, is very pretty then. The catkins are 1 to 2 inches long, each male flower having two stamens whose filaments are united by the whole or nearly the whole of their length, the bracts narrowly lanceolate and obtuse.

Salix Bockii was introduced by Wilson to the Arnold Arboretum, to which institution Kew is indebted for plants. Mr. Wilson found it in the Yang-tze Kiang valley on the margins of streams where it is often submerged during the high water season. He says it flowers there also in late autumn, and he regards it as one of the most ornamental of dwarf willows.

Salix magnifica, *Hemsley* [Salicaceae].

No more remarkable tree or shrub has been introduced from China than this. It is quite distinct among willows, to not one of which in cultivation does it bear any resemblance in leaf. It is a deciduous shrub up to 20 feet high, quite glabrous in leaf and branch; young shoots purple at first, assuming a reddish hue later. The leaves are the most remarkable part of the plant. They are oval or slightly obovate, sometimes ovate, entire, rounded or slightly cordate at the base, cuspidate at the apex, dull greyish green (with a bloom) above, pale and slightly glaucous beneath. In our young living plants they have not yet become more than 6 inches long by about 4 inches wide, but in the herbarium of the Arnold Arboretum the largest leaves on specimens collected by Wilson in China measure 8¼ inches long by 5¼ inches in width, the petiole 2 inches long. Male catkins 4 to 7 inches long; stamens 2, four times as long as the scale. Female catkins longer, sometimes as much as 11 inches.

Mr. Wilson, who discovered the species, informs me that it is very common in parts of Western Szechuen between 7000 and 10,000 feet. He also says the young shoots change to red the

first winter and remain that colour for several years. The leaves assume a golden hue before they fall. It was introduced by means of cuttings and living plants to the Arnold Arboretum in 1909, and thence to Kew the following year.

Explanation of Plates.

I. *Corylus Jacquemontii*, Decaisne. Twig with fruit ripened at Kew.

II. *Alnus cremastogyne*, Burkill. Tree 80 ft. high, 6 ft. in girth of trunk. Tartar City, Chentu. E. Szechuen, 1700 ft. Aug. 22, 1908.

III. *Cladrastis sinensis*, Hemsley. Young tree, 25 ft. high, 2 ft. in girth of trunk. Foot of Wa-shan. W. Szechuen, 5600 ft. Sept. 19, 1908.

We are indebted to Prof. C. S. Sargent for permission to use Mr. Wilson's photographs.

XXVI.—COFFEE DISEASE IN EAST AFRICA.

The recent recognition in Uganda of the coffee disease caused by *Hemileia vastatrix*, Berk. et Br. has necessitated a re-examination of the *Hemileia* material which has reached Kew from time to time from Tropical East Africa. Careful comparison of that material with type specimens of both *Hemileia vastatrix* and *H. Woodii*, Kalchbr. and Cke., has also been necessary. We are indebted to Prof. Engler for the loan of herbarium specimens of *H. Woodii* and of species of *Coffea* for comparison with the material preserved at Kew.

The first intimation that coffee disease was prevalent in Uganda reached Kew in December of last year when some badly diseased coffee leaves were received from the Government Entomologist, Uganda, but it seems clear from information since received that the disease has not suddenly appeared but has been present in the country for some time. In fact, according to a recent report by the Director of Agriculture 'native coffee leaf disease' has been well known to old residents who were under the impression that *H. vastatrix* was not the fungus in this case.

The fungus was first recorded for Tropical Africa in 1894 on cultivated coffee received from German East Africa. According to Sadebeck,* however, *Hemileia vastatrix* was found by him on leaves of *Coffea arabica* in a collection of plants made by Fischer in German East Africa in 1885.

The exact locality for the specimen was not recorded but it was believed to have been collected in the Victoria Nyanza region.

Stuhlmann in 1897† also found *H. vastatrix* in this region on leaves of a coffee which was described by Froehner as *C. arabica* var. *Stuhlmanii*.

---

* Sadebeck: "Die wichtigeren Nutzpflanzen u. deren Erzeugnisse aus den deutsch. Colonien. (3 Beih. z. Jahrb. der Hamb. Wiss. Anst. xiv. 1896, p. 93).

† Hennings Zeitschr. für Trop. Landw. 1897, i, p. 192.

These records support the view that the fungus may be endemic in Africa and may not necessarily have been introduced with imported coffee.

With regard to British East Africa *Hemileia* was first recorded in 1904 on coffee leaves from Buru* where coffee cultivation was first started in 1895. The disease is now widely spread in the Protectorate and in German East Africa and Uganda, but as yet there is no record of its occurrence in Nyasaland or in any part of the West Coast of Africa.

Coffee cultivated in plantations and the so-called 'wild coffee' are equally attacked by *Hemileia vastatrix*. The indigenous or wild coffee trees, according to the Report of the Director of Agriculture, "are scattered throughout the Buganda Kingdom in small lots of about 5 to 10 trees which receive practically no attention beyond picking the fruit when ripe."

He adds that "all the indigenous coffee, as far as can be ascertained, is covered with *H. vastatrix*."

It also appears that though so much attacked by the disease the native trees are not seriously affected by it, a fact which lends further support to the view that we may be concerned with an endemic rather than with an introduced disease.†

With regard to this so-called 'wild coffee' of Eastern Africa a good deal of confusion has arisen since it has been wrongly assumed, partly in connection with the publication of Hennings'‡ note of the occurrence of *Hemileia Woodii* on leaves of *Coffea Ibo*, that the wild or native coffee of Uganda should be referred to that species.

The history of the coffees grown in Uganda is as follows :—

The occurrence of coffee in Uganda is first mentioned by Speke in his Nile Journal, Appendix p. 636, where he states that coffee "M'wanee" is "cultivated in considerable quantities on and about the equator. The trees grow 10–12 ft. high, their boughing branches affording shade."

Stuhlmann in his account of the Uganda people in Emin Pasha's African Expedition p. 179, states that nearly every native banana plantation has its solitary coffee tree.

He also expresses the opinion (p. 720) that the coffee plants of the banana groves of Bukoba, on the German East African border of Uganda appear to be indigenous, at least not introduced by either Arabs or Europeans. The coffee referred to in this paragraph is undoubtedly the "Bukoba" coffee which was later described by Froehner as *Coffea arabica* var. *Stuhlmannii*, and which, from the examination of the type kindly lent to Kew by Prof. Engler, appears to be little more than a form of *C. robusta*, Linden. This variety was afterwards raised to specific rank by Zimmermann as *C. bukobensis*.

According to Sir Harry Johnston, (Uganda Proctectorate vol. i, p. 288) the coffee plant "whether originally introduced or not from

---

* Dept. Agric. Leaflet, B. E. Africa, No. 10. Crop diseases reported 1904–05.

† The virulence of the attack by *Hemileia vastatrix* in Ceylon may possibly be explained on the assumption that the disease was not native to the country but was introduced to the island from Africa and that the fungus under the new conditions rapidly spread and assumed epidemic proportions.

‡ Hennings Zeitschr. für Trop. Landw. 1897, i, p. 192.

Abyssinia is at any rate native now in a semi-wild form to the better forested regions of the Uganda Protectorate, its berries producing coffee of excellent flavour."

Again in vol. ii. p. 674, speaking of the Bantu people, Sir Harry says that the coffee tree is probably indigenous to the forests of Uganda and the neighbouring islands in Lake Victoria.

In 1902 J. Mahon communicated to Kew dried specimens of "the common coffee of the country, collected from bushes 20 ft. high in a deserted native garden," and other specimens grown in the Entebbe Botanic Gardens from a seedling sent from Kew in 1901. These plants are practically identical, except that the ones from the native garden have smaller leaves, as might be expected from a neglected bush, and may without doubt be referred to *C. robusta*, Linden.

It seems clear therefore that the wild coffee of Uganda which is found in native gardens and plantations is *Coffea robusta*, Linden, a species which as De Wildeman has already suggested may be merely a variety or local race of *C. canephora*, Pierre, which was originally described from specimens from the Gaboon.

To sum up therefore we have the following synonymy:

Coffea arabica, var. *Stuhlmannii*, Froehner = *C. bukobensis*, Zimmermann = *C. robusta*, Linden = *C. canephora*, Pierre, forma.

The examination of the type specimen of *Hemileia Woodii* on leaves of supposed *Coffea Ibo* collected by Perrot near Lindi in German East Africa,* has revealed the fact that the diseased leaves do not belong to that species and in fact do not belong to any species of coffee known at Kew.

Further it seems highly improbable that the fungus on these leaves is anything but *Hemileia vastatrix*. The fungus is in a very advanced state, the pustules consisting almost entirely of germinated teleutospores, which do not differ in *H. vastatrix* and *H. Woodii* in dried specimens. A few uredospores are present, however, and these are of the *vastatrix* type, having the warted convex side sharply marked off from the smooth flattened side by a ring of strong teeth. It would appear, therefore, that the plant is really an unusually advanced state of *H. vastatrix*. Teleutospores are as a rule rare in this species, and are formed after the uredospores, whereas in *H. Woodii* both forms of spore are usually found intermixed. Hennings makes no mention of these teleutospores, although at that time they had not been described for *H. Woodii*, and he therefore probably regarded them, as did Kalchbrenner and Cooke originally, as "triangular cystidia" or paraphyses, and upon these based his determination of the fungus.

The chief result of the examination of the various type specimens is therefore the establishment of the fact that there is no record of coffee being attacked by any species of *Hemileia* other than *H. vastatrix*.

Neither *H. vastatrix* nor *H. Woodii* confines its attacks to any one genus of *Rubiaceae*. At Kew *H. vastatrix* is represented only on species of *Coffea*, though there are records of its occurrence

* Hennings Zeitschr. für Tr. Landw. i, 1897, p. 192, *Kew Bull.*, 1906, p. 39.

on other genera (see *K.B.* 1906, pp. 38, 39). *H. Woodii* is known to occur on various species of *Vangueria*, on *Fadogia latifolia* and also on *Gardenia edulis* from Australia.

Another fungus, *Hemileia helvola*, Syd., found on Rubiaceous plants in the Congo, as well as *H. Woodii* might under certain conditions become adapted to coffees, but though this possibility should not be disregarded there is at present no evidence of the likelihood of such an eventuality.

XXVII.—MINOR AGRICULTURAL INDUSTRIES.*

II. The Culture of Early Flowers in Cornwall and the Scilly Islands.

W. Dallimore.

In various parts of Cornwall and the Scilly Islands a large business is carried on in the production of early flowers, more particularly Narcissi, for the English markets, and as the industry is one about which information is often sought, visits were paid to some of the principal growing centres during the third week of March for the purpose of enquiring into the conditions under which the flowers are grown and marketed, the knowledge thus obtained being summarised in the accompanying notes.

The bulb industry had its inception about 30 years ago, the object in view being the provision of a supplementary farm crop for agriculturists who had previously depended to a great extent upon the production of broccoli and early potatoes. For several years the work was largely of an experimental nature and only affected a few people but it is now included as a necessary and regular part of the routine of many arable farms and small holdings, and farmers and cottagers alike derive a certain portion of their income from the sale of flowers and bulbs.

All of the five of the Scilly Islands that are inhabited are equally interested in the industry, viz., St. Marys, Tresco, St. Agnes, St. Martins, and Bryher. On the Mainland, the neighbourhood of Penzance is the centre of the industry, although there are growers in the vicinity of Falmouth and elsewhere. Farmers thereabouts are handicapped by the long distance which separates them from important markets, hence, to recuperate themselves for losses due to heavy railway rates and packing, they rely upon the extra profit which is obtained by producing crops a few weeks earlier than is possible in a less favoured climate, for throughout winter, climatic conditions are very equable and the slight frosts which occur are at infrequent intervals. In the past, the two most approved crops for the purpose were potatoes and broccoli and these were repeated with almost unfailing regularity, almost to the exclusion of other subjects, until bulb-growing came to be thoroughly understood, when it was found to be more profitable than either of the other crops, although it entailed more work. Fortunately the deep loamy soil which produces good crops of potatoes is

* The first article on the Fuller's Teasel was published in *K.B.*, 1912, p. 345.

quite suitable for bulb culture, therefore it is possible to effect a distinct change of crop and still retain one which is remunerative.

The soil generally is a fertile loam composed largely of humus and disintegrated granite and the best land in the neighbourhood of Penzance is said to be rented at from £8 to £10 an acre. Much of that on the cliffs, however, is worth less than half that amount. Many of the bulbs are grown within a short distance of the sea, and between the village of Paul and Penzance the faces of the cliffs, from a few feet above sea-level to the summit, have been terraced to form small irregular-shaped fields which are fully exposed to the sun. The reclamation of this land from the bare hillsides has been a costly undertaking, for beneath a rough vegetation of gorse, coarse grasses, and other weeds the ground was plentifully besprinkled with pieces of granite varying in weight from a few ounces to several tons. All that could be handled were removed to a depth of $1\frac{1}{2}$ or 2 feet and built up as protection walls and windbreaks around the fields, the larger ones being left where they stood. An idea of the cost involved in this work may be gathered from the fact that the last two acres cleared on one farm, including wall building, was upwards of £60 an acre. It is possible, however, that the work would have been done much cheaper by contract.

Generally, the bulbs growing on the cliff sides are as healthy and vigorous as those planted elsewhere but in a few instances, where the foliage is sometimes washed by spray or there is insufficient shelter from wind, they are not doing well. The two most serious drawbacks to successful cultivation appear to be badly drained ground and exposure to rough winds and it is courting failure to form plantations unless proper provision is made to ensure thorough drainage and efficient shelter. In the most exposed places on the Mainland, shelter is first provided by walls of stones and soil 3 to 4 feet high, and after that by hedges of elderberry. The elderberry does not, however, appear to be an ideal plant for the purpose as it becomes leggy and thin at the bottom. In Tresco, the great hedge plant is *Escallonia macrantha* and the bulb fields are intersected by hedges 6 feet high. But these are within a shelter belt of *Pinus insignis* and *Cupressus macrocarpa* and it is doubtful whether the same plant would prove so satisfactory on the exposed cliffs near Penzance. The plants one would suggest for trial are *Euonymus japonicus*, *Olearia Haastii*, sea buckthorn, (*Hippophae rhamnoides*) common gorse, and various kinds of *Tamarix*. In one place *Fuchsia Riccartoni* was noted doing very well as a hedge in a very exposed place. Between the *Escallonia* hedges at Tresco further protection is provided by screens of the common reed (*Phragmites communis*). The reeds are collected when dry and woven between strands of wire to form long mats. These are then secured in an upright position between stout posts. In other places old fishing nets are used as a wind break but the reed mats are vastly superior and may be easily made by farm hands. Ordinary close sheep hurdles might also be introduced with advantage. There is one use for which old fish netting is well adapted, that is secured on stakes to form a screen for young hedges. Plants screened in this way develop much more rapidly than those left unprotected. Wind plays the greatest havoc

amongst the bulbs after the leaves are fully grown, although it is a disadvantage from the time growth commences. A violent wind causes the leaves to be laid almost flat on the ground, and although some rise again, many are so injured that they die prematurely and the bulbs suffer in consequence. The injurious effect of wind may be easily seen in fields where one part is more exposed than another for in the exposed places the leaves are shorter and narrower and the bulbs smaller than where there is greater protection.

The cultural methods adopted in the Scillies and on the Mainland are practically the same. As a rule ground which is to be planted with Narcissi is heavily manured and cropped with potatoes the previous spring. Favoured manures are farmyard manure, seaweed, and the various fertilisers which are rich in potash and phosphates. The potatoes are lifted between the last week in April and the end of May, and the ground is dug or ploughed, levelled, and prepared for planting as opportunity offers. No manure is given at this period but if lime is required a dressing is provided. Planting is usually done as early as possible, although, if there is proper storage convenience for the bulbs, it may be left as late as the end of September. Late planting is favoured when the ground is very weedy, as unplanted ground is cheaper to clean than that which has been planted. In the larger fields a plough is used in the planting. By its aid a shallow furrow or trench is made. Men or boys follow and place the bulbs in position and they are covered with about 4 inches of soil as the next furrow is made. The furrows are made about 9 inches apart and the bulbs are placed from 4 to 6 inches apart in the rows according to variety. Six furrows are made and planted, then a space of a foot or so is left to facilitate weeding and the gathering of the flowers. This is followed by more beds of six rows each, with paths between, throughout the field. In the smaller fields the same method is adopted but the work is usually done with spades. Some growers allow the paths to remain almost on a level with the surface of the beds but others prefer to arrange that the tops of the paths shall be a little lower than the bases of the bulbs so that in wet seasons the ground drains better and the bulbs ripen more satisfactorily. As no two growers appear to plant at quite the same distance apart it is difficult to say definitely how many bulbs are planted on an acre of ground, but usually between 200,000 and 220,000. After early planting, the ground is hoed once or twice before the shoots are near enough to the surface to be injured by the hoe and subsequently the ground is cleaned periodically until the bulbs are lifted. Lifting takes place at the end of the third year as soon as the foliage is dead. Some growers turn the bulbs out with a plough but others prefer to lift them with forks. They are carried into shallow heaps and dried, graded into three or four sizes, sometimes by hand and sometimes by machinery, and stored in heaps out of doors, or in sheds, until planting time or until they are sold as the case may be. The ground they have occupied is then manured heavily and planted with potatoes the following spring, after which it is again planted with bulbs. A distinct change of ground for a longer period is advised whenever it is possible, but the difficulty of providing proper shelter is against a long rotation of other crops. The

exchange of bulbs between the Scilly Islands and the Mainland is productive of good results as it infuses new vigour into those which show signs of deterioration.

The earlier flowers appear about Christmas and from that time until Easter flowers are gathered regularly. All are collected in the bud stage or as they are about to open, partly that they may be hastened into flower and partly that they shall not be injured by rough weather. They are placed at once in jars of water in a sunny greenhouse or shed, which is usually heated by hot water pipes, to open. When fully expanded they are tied in bunches of 12 blooms each, care being taken to exclude poor flowers and to arrange them so that all face in the same direction. Some growers place a little foliage with the flowers but the practice is not a general one, for it is said to make little or no difference to the price, whilst it increases the labour, and adds to the weight, so increasing cost of carriage. The bunches are then placed in water until a short time before they are despatched. They are then packed in light wooden boxes made to a regulation size for convenience of handling. The dimensions are roughly 23 inches long, 16 inches wide and 4 inches deep. The boxes are lined with soft paper, leaving sufficient to hang over the sides and ends to cover the flowers when packed. From two dozen bunches of the larger-sized flowers to five-and-a-half dozens of the smaller-flowered kinds are packed in each box. The lids are secured with string instead of nails for the convenience of salesmen and buyers, and when a large consignment is being sent to one place three boxes are tied together. In each case the number of bunches and the name of the variety is written on the outside for the information of commission agents and buyers, and after addressing and delivering to the boat or station the grower has finished, the commission agent paying transit charges and deducting them, together with his commission, from the proceeds of the sales. A great many flowers are sent to Covent Garden, but markets for others are found in Birmingham, Liverpool, Leeds, Manchester and other towns.

The boxes are never returned but are sold with the flowers. They are made by the farmers but the wood is purchased cut to the necessary size. Delivered at Penzance the wood costs at the rate of £15 per thousand boxes, an increase it is said, of between £3 and £4 a thousand within the last year.

During the present spring the flower crop has been smaller than usual but in a normal year every good, sound bulb planted during the previous year is calculated to produce one flower; those in their second year usually produce two flowers each and those in their third year three or more flowers each. Any which are left in the ground for a longer period deteriorate and hardly pay for gathering. Thus, an acre of ground may be said to produce a minimum of from 200,000 flowers the first year to 600,000 the third year. Ground which has been planted with small bulbs, however, gives practically no return the first year. Much of the work connected with cultivation is conducted by the ordinary hands in the regular routine of the farm but extra hands are engaged for bunching and packing. Some of these are paid by the day, a certain number of

bunches constituting a day's work, whilst others work piece work. On one of the largest farms the former practice is adopted and after the regulation number for the day has been tied, the workers are allowed to make overtime at the rate of 6*d.* an hour.

As the conditions under which the work is conducted varies to some extent in different places it was not possible to obtain definite figures regarding the actual expenses and income from an acre of ground, but anyone who requires such information can obtain a good guide from the article by Mr. J. Waugh on "Narcissus Cultivation" which appeared in the "Journal of the Board of Agriculture," for March, 1909, pp. 897–909.

With regard to the prices of flowers, the following were given me by a Penzance farmer as the average gross prices of the chief kinds grown, arranged in their order of flowering :—

Variety.	Price per dozen bunches.		Remarks.
	Earliest flowers.	Later flowers.	
Soleil d'Or	1*s.* 6*d.*	1*s.*	
Henry Irving ...	2*s.* 6*d.*	1*s.* 6*d.*	
Golden Spur ...	2*s.* 6*d.*	1*s.* 6*d.*	
Princeps	1*s.* 3*d.*	—	Keeps a steady price.
Sir Watkin	1*s.* 6*d.*	1*s.*	
Victoria	2*s.* 6*d.*	2*s.*	
Emperor	2*s.*	—	Keeps a steady price.
Empress	1*s.* 9*d.*	1*s* 6*d.*	
Poeticus ornatus ...	1*s.* 6*d.*	—	
Barrii conspicuus ...	2*s.*	—	
Scilly White ...	1*s.* 3*d.*	—	Flowers throughout the greater part of the season and keeps a steady price.

The following figures, taken from advice notes of sales conducted during Easter week, give an idea of the railway charges and salesman's commission :—Eight boxes containing 32½ dozen bunches realised £2 10*s.* 7*d.*, less 7*s.* 11*d.* expenses, and twelve boxes containing 39 dozen bunches made £3 11*s.* 11*d.*, less 11*s.* 9*d.* expenses. These were sent from Penzance to London. Of blooms sent to Manchester, ten boxes containing 33 dozen bunches were sold for £3 3*s.* but there were expenses amounting to 10*s.* 5*d.*, whilst six other boxes realised £1 4*s.* 3*d.*, with expenses of 6*s.* 2*d.* The variety in each case was Emperor. The Barrii and Poeticus varieties cost less in carriage and more bunches can be packed in a box. Twelve boxes of Poeticus ornatus sent to Manchester with the Emperors realised £4 2*s.* and the expenses were 9*s.* 11*d.*

The smaller growers appear to suffer from low prices more than those who market large quantities of flowers, probably by reason of a more limited choice of markets, whilst there are numerous complaints from both large and small growers about high railway rates and French competition. Everyone, however, whether he is a large or small grower, seems to work on his own account, and it is possible that the adoption of some scheme of co-operation would be

attended with good results. A co-operative society with a distributing centre in Penzance, in communication with the chief markets of the country, might very easily place many of the flowers to better advantage than at present, and the same with surplus bulbs; whilst manures, wood for boxes and other things might be obtained more economically.

Such a society might also be the means of extending the flower industry by encouraging the culture of other kinds of flowers. Already a few other kinds are grown, such as violets, anemones, and tulips but a larger business might be developed. *Anemone fulgens* about Penzance is less satisfactory than Narcissi for it does not give good results in succeeding years. A scheme has therefore been adopted by which roots are purchased from Dutch growers, flowered, and returned to Holland as soon as the foliage is dead.

Richardia africana, the so-called "calla" or "arum lily" thrives remarkably well on the cliffs about Penzance. Several large masses were noted with leaf stalks 3 feet long bearing blades 15 inches by 9. The flower stalks were up to 4 feet in height. The inflorescences have not been marketed but there appears to be a future for them provided the plants could be covered with lights whilst the spathes are developing. From the manner in which this plant is thriving, there can be little doubt but that it will prove valuable for the cut flower trade; but a few experiments are required in order to discover the best means of finishing and marketing the spathes.

Amongst other people I am much indebted to Mr. J. Mitchell of Lower Kemyell near Penzance, for the information he so kindly imparted, and to Mr. Dorrien Smith of Tresco Abbey who gave me every facility for studying the system of culture conducted in his bulb grounds at Tresco.

Perhaps to the latter gentleman more than to anyone else the credit is due of having originated the early flower industry in the Scilly Islands and indirectly about Penzance. It came into being at a time when a wave of agricultural depression was passing over those out of the way parts of the country and it has been instrumental in raising many farmers from financial embarrassment to a comfortable position. Throughout the 30 years during which this gentleman has been growing bulbs on the Island of Tresco, he has, with the assistance of an energetic and sympathetic bailiff, spared neither time nor money in perfecting both cultural and marketing arrangements, the results of the experience thus gained being freely shared with his fellow islanders.

On this estate alone, some 70 acres of bulbs are cultivated and, in addition to the flowers which are grown out of doors, many hundreds of thousands are forced annually, a number of long, low, market houses having been erected for this purpose and for tomato-growing in summer. The flower shed is a model of its kind and is representative of the methodical and business-like arrangements which everywhere exist. The front only is of glass which can be shaded with light blinds when necessary. Immediately before the glass is a stage about 3½ or 4 feet high, the upper six inches having been converted into a water-trough, the bottom of which is covered with small stones. Over the trough are trellises divided into

two-inch squares. The middle of the shed contains a long wide table for bunching and packing. As the flowers are tied in bunches two bunches are placed in each square of the trellis, the stalks in this way standing in water. An hour or so before packing, the water is drained off and the stalks drain quite dry through standing on the stones. Early in the morning all hands begin to pack, the boxes having been prepared overnight, and in a very short space of time 200 or 300 boxes are ready for despatching. On Easter Monday morning 10,000 bunches were packed and despatched in a little over an hour, about 30 men and boys being employed on the work. In addition a large number of parcel post boxes were sent away. As the Penzance boat starts from Scilly between 9 and 10 o'clock in the morning, and only on alternate days, the early morning hours are amongst the busiest of the day for the weight of flowers despatched from the several islands is reckoned in tons. The crop this year was far below the average, 225 tons against 987 tons last year. The heaviest consignment despatched from the islands was 17 tons on March 18th, against a record of 53 tons on March 21st, 1907.

A great many kinds of Narcissi are grown at Tresco but the following sorts are chiefly relied upon for market:—Soleil d'Or, Scilly White, Grand Monarque, Gloriosus, Poeticus ornatus, P. "Horace," Cynosure, Leedsii, Frank Miles, Emperor, Empress, M. J. Berkeley and Golden Spur. Various new kinds are under trial for market work whilst numerous other sorts are grown for their bulbs which find a ready sale at lifting time.

XXVIII.—DIAGNOSES AFRICANAE. LIV.

1441. **Boscia Dawei**, *Sprague et M. L. Green* [Capparidaceae—Capparideae]; affinis *B. caloneurae*, Gilg, a qua foliis longius petiolatis in basin haud cuneato-angustatis, racemis vix pedunculatis, pedicellis longioribus differt.

Arbor parva vel frutex (*Dawe*). *Rami* annotini glabrescentes, griseo-brunnei, 17–25 cm. longi, circa basin 3 mm. diametro, seniores nodosi. *Folia* ramorum annotinorum ramulis abbreviatis pulviniformibus axillaribus insidentia, oblanceolato-oblonga vel obovato-oblonga, ex apice obtuso vel rotundato saepius mucronata, in basin leviter angustata, 2·5–4 cm. longa, 1–1·2 cm. lata, coriacea, supra glabra, nervo intermedio leviter impresso, subtus minute pilosa, nervo intermedio prominente, nervis lateralibus utrinque inconspicuis; petioli 4–5 mm. longi, dense breviter pilosi; stipulae subulatae, ad 2 mm. longae. *Racemi* simplices, solitarii, axillares, nonnunquam inferne folia 1–3 gerentes, floribus dense confertis ideoque corymbosis, 1·5–2 cm. longi et diametro; rhachis et pedicelli breviter patenter pilosi; bracteae spatulato-filiformes, circiter 2·5 mm. longae; pedicelli 5–9 mm. longi, patentes. *Sepala* patentia, ovata, 3 mm. longa, 2 mm. lata, utrinque, praesertim extra, puberula, dense papillato-ciliata. *Discus* fimbriatus, 1 mm. altus. *Stamina* 6–7; filamenta 3·75 mm. longa; antherae 0·75 mm. longae.

Gynophorium 2 mm. longum, glabrum. *Ovarium* ovoideum, 1·5 mm. longum, 1 mm. diametro, 1-loculare, placentis duabis ; ovula 10.

Tropical Africa. Uganda : Ankole, *Dawe* 383.

1442. **Boscia patens**, *Sprague et M. L. Green* [Capparidaceae—Cappariдeae] ; affinis *B. angustifoliae*, A. Rich. et *B. corymbosae*, Gilg ; ab illa floribus minoribus, inflorescentia paniculata ramis patentibus, ab hac ramis paniculae anguste pyramidalibus differt.

Rami glabri, hornotini graciles, fulvi, nodosi, inconspicue lenticellati, seniores virgati, griseo-brunnei, dense lenticellati, 30 cm. infra apicem circiter 4 mm. diametro. *Folia* ramulorum hornotinorum alterna, ramorum seniorum ramulis abbreviatis pulviniformibus axillaribus insidentia, oblanceolato-oblonga vel obovato-oblonga, superne rotundata vel obtusa, rarius retusa, spinuloso-apiculata, in basin angustata, 2–4 cm. longa, 0·8–1·3 cm. lata, minute calloso-denticulata, coriacea, glabra, supra leviter convexa, nervo intermedio supra impresso subtus prominente, utrinque venulis validis dense reticulata ; petioli 2–4 mm. longi, supra densiuscule pilosi ; stipulae triangulari-subulatae, vix 1 mm. longae. *Racemi* compositi, pyramidales, 4–6 cm. longi, ramulos hornotinos foliatos terminantes vel e pulvinis orti ; rhachis glabriuscula vel superne minute puberula, ramis patenter puberulis ; bracteae anguste lanceolato-lineares, 2–2·5 mm. longae, stipulis minutis ; pedicelli 4 mm. longi, puberuli. *Sepala* ovata, patula, 3 mm. longa, 1·75 mm. lata, dense papillato-ciliata. *Discus* fimbriatus. *Stamina* 6–8, intra discum basi gynophorii inserta ; filamenta 1·75 mm. longa. *Gynophorium* 1·25 mm. longum. *Ovarium* ovoideum, 1-loculare, placentis duabus ; ovula circiter 10. *Bacca* subglobosa, circiter 4 mm. diametro, dense elevato-punctata, glabra. *Semina* ad 8.

Tropical Africa. British East Africa : Muka, *Kässner* 906.

1443. **Boscia Powellii**, *Sprague et M. L. Green* [Capparidaceae—Cappariдeae] ; affinis *B. salicifoliae*, Oliver, a qua floribus majoribus, foliis latioribus in basin valde angustatis, nervis magis distinctis differt.

Arbor parva. *Rami* hornotini pubescentes, 7–33 cm. longi, circa basin 2·5–3 mm. diametro, seniores glabrescentes, pallide fulvi, dense inconspicue lenticellati. *Folia* alterna, oblanceolata vel elliptico-oblanceolata, ex apice obtuso apiculata, in basin sensim angustata, 7–11 cm. longa, 2·5–3 cm. lata, tuberculis minutissimis asperula, utrinque minute puberula, supra nervis prominulis, subtus nervo intermedio prominente, nervis lateralibus prominulis ; petioli 1–1·5 cm. longi, dense breviter pilosi ; stipulae subulatae, circiter 1 mm. longae. *Racemi* simplices, laxiusculi, axillares, superiores plus minusve conferti, circiter 31 cm. longi ; rhachis minute puberula ; bracteae caducae ; pedicelli 4–8 mm. longi, puberuli. *Sepala* ovata, deflexa, 5 mm. longa, 3 mm. lata, utrinque minute puberula, dense papillato-ciliata. *Discus* crassus, fimbriatus, 1 mm. altus, laciniis brevissimis multiseriatis. *Stamina* circiter 18 ; filamenta 8·5 mm. longa ; antherae 1 mm. longae. *Gynophorium* 7 mm. longum, leviter pubescens. *Ovarium* ovoideum, 1-loculare, placentis duabus ; ovula circiter 10. *Bacca* globosa, circiter 7 mm. diametro, glabra.

Tropical Africa. British East Africa : Makindu and Kibwezi, *Powell* 17.

1444. **Protorhus namaquensis**, *Sprague* [Anacardiaceae-Rhoideae]; species foliis linearibus distincta.

Rami exstantes usque ad 4 mm. diametro, irregulariter sulcato-rugosi, pallide brunnei; ramuli patuli vel ascendentes, 9–15 cm. longi, dense foliati, rubro-castanei, glabri, sicco longitudinaliter rugosi, circa basin 2·5–3 mm. diametro. *Folia* linearia, utrinque angustata, acute apiculata, 4–7 cm. longa, 3–4 mm. lata, coriacea, glabra, cartilagineo-marginata, supra obscure viridia, nervo intermedio prominulo brunneo, nervis lateralibus saepius occultis, subtus pallide viridia, glaucescentia, nervo intermedio prominente brunneo vel castaneo, nervis lateralibus valde sinuatis leviter impressis nigrescentibus; petioli applanati, 2–3 mm. longi. *Thyrsi* ramulos terminantes, inferne foliati, rhachi valde anfractuosa; pedicelli curvati, circiter 2 mm. longi. *Flores* ♀ tantum visi. *Sepala* late ovata vel subdeltoidea, obtusa vel rotundata, inaequalia, 0·8–1·3 mm. longa, 0·8–1 mm. lata, extra minute pilosa. *Petala* oblonga vel elliptico-oblonga, 3 mm. longa, 1·6–1·7 mm. lata, apice rotundata, intus minute papillosa. *Staminodia* 1·3 mm. longa. *Discus* annularis, 0·3–0·4 mm. altus. *Ovarium* subglobosum, circiter 1·7 mm. altum, 1-loculare; stylus crassus, 0·7 mm. longus, stigmatibus reflexis.

South Africa. Little Namaqualand, *Wyley* (Herb. Trin. Coll. Dublin).

1445. **Vangueria Dalzielii**, *Hutchinson* [Rubiaceae-Vanguerieae]; *V. velutinae*, Hiern, habitu similis sed ramulis foliisque glabris valde distincta.

Frutex erectus; rami teretes, cortice cinereo deciduo obtecti; ramuli juniores foliati, virides, glabri, internodiis 1–2 cm. longis. *Folia* opposita vel 3–4-natim verticillata, sessilia vel breviter peliolata, obovata vel elliptico-obovata, apice obtusa vel breviter obtuse acuminata, basi paulo angustata, 3–5 cm. longa, 1·5–3 cm. lata, margine integra et anguste cartilaginea, utrinque glabra, infra glauco-viridia, nervis lateralibus utrinque 5 obliquis distinctis infra paulo prominentibus, venis subinconspicuis; stipulae interpetiolares, e basi lata subulato-lanceolatae, obtusae, vix 3 mm. longae, intra basi longe pilosae. *Flores* ad nodos ramulorum defoliatorum fasciculati; pedicelli usque ad 5 mm. longi, glabri. *Receptaculum* ambitu campanulatum, 1·5 mm. longum, glabrum. *Calycis* lobi 5, lineari-lanceolati, subobtusi, 2 mm. longi, 0·5 mm. lati, carnosi, extra glabri, intra minute puberuli. *Corollae* tubus rectus, subcylindricus, 3 mm. longus, medio 1·5 mm. diametro, extra glaber vel parce puberulus, intra infra medium annulo pilorum reflexorum instructus, supra medium pubescens; lobi 6, lanceolati, breviter apiculati, 3 mm. longi, 1·5 mm. lati, subcarnosi, glabri. *Antherae* inclusae, 0·75 mm. longae; filamenta corollae tubo adnata. *Ovarium* 5-loculare; stylus breviter exsertus, 5 mm. longus, glaber, utrinque paulo angustatus; stigma cylindrico-capitatum, 1·25 mm. longum, 0·75 mm. diametro, minute bifidum. *Fructus* 1–2 loculares, subglobosi vel oblique ellipsoidei, circiter 1 cm. longi, calycis lobis coronati.

Tropical Africa. Northern Nigeria: Katagum District, *Dalziel* 379.

Dr. Dalziel states that the plant is used as a remedy for arrow poison.

The vernacular name is "Bi ta ka tsira."

1446. **Senecio baberka**, *Hutchinson* [Compositae-Senecionideae]; affinis *S. Marlothiano*, O. Hoffm., sed foliis plerumque minoribus semper integris, involucri bracteis angustioribus differt.

Herba usque ad 30 cm. alta; caules simplices vel parce ramosi, erecti, subteretes, glabri, internodiis 1·5–2·5 cm. longis. *Folia* sessilia, lanceolata vel oblanceolata, apice obtusa, basi angustata, 1·5–4·5 cm. longa, 3–8 mm. lata, integra, tenuiter chartacea, glabra, pallide viridia, e basi 3–5-nervia, nervis cum margine subparallelis utrinque prominentibus. *Capitula* flava, solitaria, longe pedunculata, radiata, ambitu oblonga, 1·5 cm. longa et diametro; pedunculi 4–15 cm. longi, ebracteati, circiter 1·5 mm. crassi, glabri. *Involucri bracteae* uniseriatae, liberae, lineares vel lineari-oblongae, obtuse acuminatae, 1 cm. longae, coriaceae, margine membranaceae, praeter apicem puberulum, utrinque glabrae. *Receptaculum* leviter concavum, laeve, circiter 5 mm. diametro. *Flores radii* fertiles, pauci; corollae tubus cylindricus, 6 cm. longus, glaber; lamina oblonga, apice trifida, 7 mm. longa, 3mm. lata, 6–nervia, glabra; pappus corollae tubo aequilongus; stylus vix exsertus. *Flores disci* numerosi; corollae tubus anguste obconicus, 7 mm. longus, glaber; lobi 5, ovato-triangulares, obtusi, 1 mm. longi, extra rufo-pubescentes; antherae 2·5 mm. longae; stylus leviter exsertus, bilobus, lobis truncatis apice pubescentibus; pappus 6 mm. longus, barbellatus; achaenia lineari-oblonga, 7 mm. longa, costata, costis breviter albo-pubescentibus.

Tropical Africa. Northern Nigeria: Katagum District, *Dalziel* 390.

According to Dr. Dalziel the vernacular name is "Baberka," and the plant produces a bitter medicine.

1447. **Asystasia Drake-Brockmanii**, *Turrill*, [Acanthaceae-Acanthoideae]; ab affini *A. macrophylla*, Lindau, foliis minoribus facile distinguenda.

Herba erecta: caules teretes vel obscure quadrangulares, supra sulcati, primo pubescentes, mox glabri. *Folia* late ovata, apice obtuse acuminata, basi subrotundata vel cuneata, usque ad 4·5 cm. longa et 3·5 cm. lata, chartacea, pagina utraque minute pubescentia, margine integra, nervis lateralibus utrinque circiter 5; petioli 2–3 mm. longi, pubescentes. *Inflorescentia* terminalis vel axillaris, pluriflora; pedicelli usque ad 1·3 cm. longi, pubescentes; bracteae inferiores foliis similes sed minores et sessiles, superiores lanceolatae vel lineares, acutae, sessiles, circiter 3·5 mm. longae et 0·75 mm. latae, pubescentes; bracteolae 2, lineares, apice acutae, sessiles, 4–5 mm. longae, 0·5 mm. latae, pubescentes. *Sepala* 5, omnino libera, inter se aequalia, linearia, apice acuta, 3 mm. longa, 0·75 mm. lata, leviter pubescentia. *Corollae* tubus circiter 3·5 cm. longus, infra cylindricus, 2–3 mm. diametro, superne ampliatus, circiter 1·5 cm. diametro, extra glaber, intra parte inferiore pubescens; limbus circiter 4 cm. diametro, 5–lobatus, lobis rotundatis inter se subaequalibus, circiter 1·3 cm. diametro. *Stamina* 4, filamentis 2 longioribus 1·3 cm. longis, 2 brevioribus 8–9 mm. longis, omnibus glabris; antherarum loculi 2, uno altero paulo altiore affixo, glabri, apice obtusi, basi omnes calcare bidentato instructi; pollinis granula oblongo-ellipsoidea, 75 μ longa, 45 μ diametro. *Discus* cupuliformis, 1 mm. altus, ovarium cingens,

Ovarium conicum, 3·5 mm. altum, 1·5 mm. diametro, glabrum vel apice leviter pubescens, ovulis in loculo quoque 2 ; stylus 2·5 mm. longus, inferne pubescens, superne glaber, stigmate capitato indistincte bilobato.

Tropical Africa. Abyssinia: Geru Abbas, *Drake-Brockman* 230.

1448. **Ecbolium longiflorum**, *Turrill* [Acanthaceae-Justiciae]; *E. striati, var minore*, Balfour, affinis sed foliis junioribus dense pubescentibus, bracteis brevioribus, corollae tubo multo longiore facile distinguenda.

Frutex 1 m. altus (ex *Methuen*), ramis teretibus adpresse albopuberulis. *Folia* juniora suborbicularia, apice rotundata, basi cordata, 4·5 mm. longa, 4·5 mm. lata, utrinque dense pubescentia. *Spicae* anguste cylindricae, compactae, multiflorae, internodiis inconspicuis ; bracteae oblongo-lanceolatae, apice acutae, 2·75 mm. longae, 1·5 mm. latae, dense puberulae ; bracteolae lineari-lanceolatae, 2 mm. longae, 0·75 mm. latae, dense puberulae. *Sepala* 5, linearia, apice acuta, 4 mm. longa, 0·75 mm. lata, glandulosopuberula. *Corollae* tubus anguste cylindricus, 3·5 cm. longus, medio 0·75 mm. diametro, ima basi 1·5 mm. diametro, extra pubescens, intus glaber ; limbus distincte bilabiatus, extra pubescens, intus glaber ; labium anticum trilobatum, lobis lateralibus ellipticis apice obtusis 1·2 cm. longis 5·5 mm. latis, lobo intermedio obovato apice rotundato 1·2 cm. longo 1 cm. lato ; labium posticum lineare, apice leviter bifidum, 1 cm. longum, 1 mm. latum. *Stamina* 2, filamentis 2·5 mm. longis glabris, antheris typicis 2·5 mm. longis ; pollinis granula globosa, 55 μ diametro. *Ovarium* subcylindricum, 3 mm. longum, 0·75 mm. diametro, dense puberulum, typice 4-ovulatum ; stylus 3·4 mm. longus, inferne pubescens ; stigma indistincte bilobatum. *Capsula* ovoidea, stipitata, compressa, 1·5 cm. longa, 7 mm. diametro, puberula, 3-seminata (an semper ?). *Semina* ovata, valde compressa, apice obliqua, 6 mm. longa, 4 mm. lata, laevia.

Madagascar. Tongobory, *Hon. P. A. Methuen.*

1449. **Loranthus entebbensis**, *Sprague* [Loranthaceae]; affinis *L. Schweinfurthii*, Engl., a quo indumento, foliis minoribus, floribus majoribus, toro multo majore bracteam multo superante differt.

Innovationes pilis verticillato-ramosis ferrugineo-tomentosae. *Ramuli* pallidi, glabrescentes, exsiccando longitudinaliter rugosi, nodosi, 30 cm. infra apicem circiter 4 mm. diametro ; internodia 4–12 mm. longa. *Folia* opposita vel tandem alterna, ovata usque lanceolata, apice obtusa, basi plus minusve cuneata, 4–6·5 cm. longa, 1·8–3·8 cm. lata, coriacea, nervis subtus sparse ferrugineo-pilosis exceptis glabra ; nervi laterales utrinque circiter 5, satis obliqui, utrinque prominuli ; costa supra prominula, subtus prominens ; petioli 9–13 mm. longi, ferrugineo-pubescentes. *Umbellae* axillares, solitariae, 9–10-florae ; pedunculus in toto circiter 5 mm. longus, ferrugineo-puberulus ; pedicelli 3–4 mm. longi, crispule pubescentes ; bractea e basi patelliformi valde unilateralis, ovata, vix 2 mm. longa, dorso umbonato-incrassata, margine ventrali 0·5 mm. alto. *Torus* calycecum suburceolatus, 3·5–4 mm. longus, 2·7 mm. diametro, ferrugineo-pubescens. *Calyx* in toto 0·7–0·8 mm. longus, ciliatus, dentibus deltoideis 0·3–0·4 mm. longis pilis inclusis ; discus

intramarginalis adnatus, 0·3 mm. altus. *Corolla* circiter 5 cm. longa, extra ferrugineo-puberula, parte apicali alabastro oblonga obtusa 5·5 mm. longa pentagona inter angulos excavata; tubus circiter 1·4 cm. unilateraliter fissus, ampulla basali oblongo-ovoidea 7–8 mm. longa; lobi erecti, spatulato-lineares, 1·1 cm. longi, parte superiore subnaviculiformi acuta 5·5 mm. longa 1·4 mm. lata 0·8 mm. crassa, strato duro basi abrupte terminata. *Filamenta* basi corollae loborum inserta, deflexa vel involuta, 7 mm. longa, sursum sensim angustata, superne 1 mm. incrassata, pallidiora, dente 0·3 mm. longo; antherae lineares, 3 mm. longae. *Discus* crassus, 0·6–0·7 mm. altus, breviter dentatus. *Stylus* superne metuliformis, parte incrassata circiter 8 mm. longa inter costas valde canaliculata, collo 3 mm. longo; stigma ellipsoideum, 0·8 mm. longum.

Tropical Africa. Uganda: Entebbe, *Rutter*.

Specimens of *L. entebbensis* were received for identification from Mr. W. R. Rutter, Chief Forestry Officer, Uganda, according to whom the species is attacking most of the trees in the township of Entebbe.

L. entebbensis is closely allied to *L. Schweinfurthii*. The nature of the indumentum affords an important distinction. In *L. entebbensis* it is composed of longish rusty much-branched hairs which soon fall off, whereas in *L. Schweinfurthii* the hairs are short, pale, little-branched and relatively persistent.

1450. **Cyrtanthus epiphyticus**, *J. M. Wood* [Amaryllidaceae-Amarylleae]; affinis *C. Macowani*, Baker, sed foliis duplo latioribus, perianthii lobis suborbicularibus vel late ellipticis et habitu epiphytico differt.

Bulbus 9–11 cm. longus, 3–3·5 cm. crassus, basi ovoideus, superne in collum elongatum attenuatus, brunneus. *Folia* 2, cum floribus coaetania, 30–50 cm. longa, 2·5–3·5 (sicco 1·2–1·8) cm. lata, late linearia, apice et basi attenuata, obtusa, plana, nec torta, viridia, subtus vix glauca, costa subtus valde prominente. *Scapus* subteres, foliis brevior, basi curvatus, viridis. *Spathae* valvae duae, 3–3·5 cm. longae, 6–8 mm. latae, lanceolato-attenuatae, membranaceae. *Umbellae* 7–15-florae. *Pedicelli* 1·5–2·8 cm. longi, virides. *Perianthium* coccineum; tubus 3–3·5 cm. longus, curvatus, fauce 8 mm. diametro, basi gradatim attenuatus; limbus 1·4–1·6 cm. diametro; segmenta 6–7 mm. longa et lata, suborbicularia vel late elliptica, apice late rotundata, exteriora apiculata. *Stamina* inclusa, biscriata; filamenta brevissima; antherae oblongae, dorsifixae. *Ovarium* trigonum, luteo-viride; stylus staminibus longior, filiformis; stigma 3-lobum. *Capsula* 1·5–2 cm. longa, oblonga, glabra. *Semina* 6–7 mm. longa, 2·5 mm. lata, alata, samaroidea, obtusa, nigra.

South Africa. Natal: in a forest at Ensikeni, at 1200 m. alt., near the border between Natal and Griqualand East, growing epiphytically, with their bulbs embedded in the moss on the trunks and branches of a species of *Podocarpus* (Yellowwood), sometimes at an elevation of 20 m. or more above the ground, *Wood* 12,041.

This appears to be the first Amaryllidaceous plant recorded as being epiphytic. In a letter sent to Kew, Mr. Wood states that the plant was discovered by his adopted son, Mr. Walter Haygarth,

who found it "growing on stems and branches of Yellowwood trees, always in tufts of moss, which its roots penetrate, but do not, I think, even touch the bark of the tree. The only plants on the ground were a few, not many, that had been dislodged from the trees by the wind or by falling branches, and these were all still growing in the moss which had fallen with them. He also found a few growing in crevices of rocks, but again imbedded in moss." In form, the seeds are remarkably like the fruit of a Maple or Sycamore on a very reduced scale, and are admirably adapted for dispersal by wind.

XXIX.—THE STERILISATION OF SEED.

(With Plates.)

Ivy Massee.

The sterilisation of seed is, in many instances, a necessary preliminary to work on plant physiology. Two different methods have been followed: in the one case sterilisation is effected by mechanical means, and the seeds are first washed in a sterilised liquid and then thoroughly shaken up in sand. This method was followed by Mazé in his researches on the development of maize; but is only practicable when the testa of the seed is smooth. The second, and more usual method is to treat the seed with an antiseptic substance, mercuric chloride being most frequently used. This has proved unsatisfactory for the following reasons: the spores of certain bacteria are resistant to such treatment; the presence of the antiseptic often contaminates the culture medium, and thirdly the seed tends to be injured if the treatment is prolonged.

Formaldehyde has also been used, but in some cases, as shown by Kehler,* the seeds treated proved more susceptible to injury than the spores of the fungi or bacteria it was sought to destroy.

Owing to the unsatisfactory results of the methods of sterilisation usually employed, de Zeeuw† experimented with various other substances and decided in favour of hydrogen peroxide (H_2O_2). Pinoy and Magrou‡ have also experimented with hydrogen peroxide and give a favourable report of the results.

According to the last-named authors, it was found that after the seed had been immersed in hydrogen peroxide for 5 hours, all spores were killed, yet the germination of the seed was not much retarded, and in certain instances it was even hastened. Treated seeds of *Orobus tuberosus* germinated in eight days, whereas untreated seeds of the same plant required a month to germinate.

All the above experiments were conducted with the object of obtaining, for physiological research, seeds absolutely free from living germs, more especially bacteria. It was suggested to me by my father that the action of hydrogen peroxide on fungus spores and on the germination of seed might prove to be of great value in preventing the spread of plant diseases due to the presence of fungus spores on seed. For the purpose of testing this idea, a series of experiments have been made in the Jodrell laboratory.

In the first place, in order to test the action of hydrogen peroxide on the vitality of seeds, two batches of seed of each kind experimented on were soaked in hydrogen peroxide for 4 hours and 24 hours respectively, and a control batch, of each kind of seed, was soaked in water for a corresponding length of time. All the soaking was done in closed glass dishes.

In every instance seed treated with hydrogen peroxide was retarded in germination, as compared with seed soaked in water for a corresponding length of time. The germination of the seed soaked in hydrogen peroxide for 24 hours was much more retarded than of that soaked for 4 hours.

On the other hand, seedlings from treated seed grew at a quicker rate than those from untreated seed, and as a rule, within a fortnight were equal in size or even larger than the plants raised from the untreated seed. Certain kinds of seed were killed after being treated for 24 hours. In every instance, except where the treated seed was killed outright, the percentage of germination was equal in treated and untreated seed, and, as a rule, every seed germinated. Fuller details are given in the accompanying table.

In testing the vitality of treated fungus spores, very much the same course was followed as that described for seeds. Pinoy and Magrou found that immersion for five hours destroyed all germs present on seeds; but they were mostly concerned with bacteria which are much more resistant to the action of hydrogen peroxide, and to other germicides also, than are the spores of fungi.

Judging from my experiments on fungus spores and on seed, immersion in hydrogen peroxide for three hours is sufficient to kill all fungus spores present on the surface, without, so far as is known, causing injury to the seed.

Batches of a few different kinds of fungus spores treated for half an hour only, showed accelerated germination as compared with spores soaked in water for the same length of time.

The seed should be treated in closed vessels, bottles, &c., which should be shaken at intervals, otherwise a layer of air bubbles tends to surround the seed and so prevent the action of the fungicide. This method of sterilising seed should prove of value, in addition to home use, in those instances when sterilisation of seed is insisted upon in other countries and should supersede sterilisation of seed by fumigation, which, although it may be effective against insect pests, is comparatively useless so far as the spores of fungi are concerned. In the event of using this method for sterilising seed, it would be best in the first case to experiment on a small quantity of seed in order to test the effect of the hydrogen peroxide on the vitality of the seed before treating a large consignment.

It is doubtful whether hydrogen peroxide would prove of value in killing hibernating mycelium which might be present in bulbs, tubers, &c. Only one experiment in this direction has been made, with the mycelium of the *Botrytis* causing the well-known "Lily disease," present in the stem of a lily. Two pieces of lily stem were treated for 24 hours, and afterwards the fungus grew freely and produced fruit, while on the control piece of the same stem, soaked in water for an equal length of time, the mycelium grew very slowly as compared with the treated pieces.

[*To face page* 184.

CUCURBITA PEPO. PLANTS AFTER BEING SOWN 5 DAYS.

I. Untreated. II. Treated 4 hours. III. Treated 24 hours.

CUCUMIS MELO. PLANTS AFTER BEING SOWN 8 DAYS.

I. Treated 4 hours. II. Not treated. III. Treated 24 hours.

The hydrogen peroxide used is known as "commercial, 10 vols." and was not diluted. The price is 5*s*. per gallon. The same liquid may be used for treating several consecutive batches of seed, until its fungicidal action becomes exhausted. It is fit for use so long as it is capable of bleaching a rose-coloured solution of permanganate of potash, to which a few drops of sulphuric acid have been added. (Condy's fluid may be used as a substitute for permanganate of potash.)

Hydrogen peroxide keeps better when the vessel containing it is completely filled; it should also be kept in a cool place, and in the dark. Taking everything into consideration, sterilisation of seed by means of hydrogen peroxide is cheaper and much more effective than by any method of fumigation known. The preparation of hydrogen peroxide is a simple process, and in tropical countries where its deterioration would be hastened, it would be advisable to have it prepared on the spot.

In the following tables the particulars of the experiments on various seeds and fungus spores are given in detail:—

TREATMENT OF SEED.

Name of seed, and number sown.	Time of treatment.	First appearance above ground.	Remarks.
Cucurbita pepo (6) ...	untreated ...	4 days	After 8 days plants from treated and untreated seeds were, on an average, of equal size; while after 14 days the batches treated for 24 hrs. showed most growth.
	treated 4 hrs.	5 days	
	treated 24 hrs.	6 days	
Trichosanthes anguina (6).	untreated ...	6 days	
	treated 4 hrs.	7 days	
	treated 24 hrs.	8 days	
Cucumis melo (14) ...	untreated ...	4 days	
	treated 4 hrs.	5 days	
	treated 24 hrs.	6 days	
Lagenaria vulgaris (6)	untreated ...	4 days	
	treated 4 hrs.	5 days	
	treated 24 hrs.	6 days	
Acacia Richii (3) ...	untreated ...	7 days	
	treated 24 hrs.	killed	
Clitoria glycinoides (3)	untreated ...	8 days	Treated seed produced feeble seedlings.
	treated 24 hrs.	16 days	
Caesalpinia pulcherrima (3).	untreated ...	14 days	
	treated 24 hrs.	killed	
Bauhinia tomentosa (3)	untreated ...	14 days	
	treated 24 hrs.	killed	
Sweet Peas—			Plants from treated and untreated seeds equal in size 5 days after the treated plants appeared above ground.
Evelyn Hemus (10)	untreated ...	7 days	
	treated 24 hrs.	11 days	
Dainty Spencer (10)	untreated ...	7 days	
	treated 24 hrs.	14 days	
Lord Nelson (10) ...	untreated ...	7 days	
	treated 24 hrs.	killed	
Ricinus communis (2)	untreated ...	6 days	Plants from treated and untreated seeds equal in size from the first.
	treated 4 hrs.	6 days	

TREATMENT OF FUNGUS SPORES.

Name of spores.	Treatment.	Germination.	Remarks.
Ustilago avenae, Jensen	not treated ...	24 hrs. ...	Germination abundant.
	treated ½ hr. ...	all killed	Spores bleached. Protoplasm contracted.
Ustilago Vaillantii, Tul.	not treated ...	24 hrs. ...	Hemibasidium formed but not free.
	treated ½ hr. ...	24 hrs. ...	More forward than untreated lot.
	treated 2 hrs.	three days	Germination feeble. Many killed.
	treated 4 hrs.	all killed	
Uromyces ficariae, DC.	not treated ...	24 hrs. ...	Germination abundant.
	treated 1 hr. ...	all killed	
Aecidium ranunculacearum, DC.	not treated ...	24 hrs. ...	Germination very vigorous.
	treated 1 hr. ...	all killed	
Sclerotinia sclerotiorum, Mass.	not treated ...	24 hrs. ...	Did not germinate in water, but freely in decoction of prune juice.
	treated ½ hr. ...	all killed	
Leptosphaeria acuminata, Sacc.	not treated ...	two days	Vigorous germ-tube from every cell of the spore.
	treated 1 hr. ...	all killed	
Erysiphe graminis, DC.	not treated ...	24 hrs. ...	Germination abundant.
	treated 1 hr. ...	all killed	
Macrosporium solani, Cke.	not treated ...	24 hrs. ...	Mycelium rampant in 24 hrs.
	treated 1 hr. ...	all killed	
Heterosporium echinulatum, Berk.	not treated ...	24 hrs. ...	The spores were 3 months old. Germination vigorous.
	treated 1 hr. ...	all killed	
Cladosporium epiphyllum, Pers.	not treated ...	24 hrs ...	Germination abundant, all put up in decoction of prune juice.
	treated ½ hr. ...	24 hrs. ...	
	treated 2 hrs.	all killed	
Verticillium lateritium, Berk.	not treated ...	two days	Germination vigorous. After 5 days, broken sporophores in the treated batch sprouted vigorously and produced chains of oidia.
	treated 1 hr. ...	all killed	

SUMMARY.

The spores of fungi, also some kinds of bacteria, are as a rule killed by an hour's immersion in hydrogen peroxide; no spores experimented with germinated after similar treatment for two hours.

In nearly every instance the germination of seeds immersed in hydrogen peroxide was retarded. Seeds immersed for four hours were on an average 1–2 days later in appearing above ground than untreated seeds of the same kind. Seeds treated for twenty-four hours were retarded from two to eight days, or in most instances were killed outright. The period of retardation is much less in

seeds which germinate quickly than in the case of seeds whose germination is normally slow. After treated seeds have germinated growth is rapid, and in a short time the plants are equal in size and vigour to the plants from untreated seeds sown at the same time. In some cases the plants from treated seeds are distinctly larger than those from untreated seeds at the end of three weeks. For all practical purposes, soaking seed in hydrogen peroxide for three hours will kill all superficial fungus spores and the seed will not be injured. This method is to be recommended as a substitute for fumigation, which, as a rule, does not kill fungus spores, unless continued for such a time as to damage the seed.

LITERATURE.

* *Kehler*, Dissert. Konigsberg, 1904.
† *De Zeeuw*, Centralb. für Bakt. 31, p. 4.
‡ *Pinoy & Magrou*, Bull. Soc. Bot. France. 12, n.s., p. 609.

XXX.—DECADES KEWENSES

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS LXXIII.

721. **Rourea breviracemosa**, *Gamble* [Connaraceae-Connareae]; *R. caudatae*, Planch., affinis, foliolis numerosioribus haud caudatis et racemis multum brevioribus differt.

Frutex erectus vel scandens, ramulis gracilibus angulatis. *Folia* imparipinnata, ad 20 cm. longa; foliola alterna, distantia, circa 10–12, lanceolata, apice obtuse acuminata, basi cuneata, glabra, 4–7 cm. longa, 2–2·5 cm. lata, nervis utrinque 4–5, reticulatione areolata; petioluli 1–2 mm. longi. *Racemi* axillares, 1–1·5 cm. longi, 8–10-flori; bracteae minutae, subulatae, cum rhachi sericopuberulae; pedicelli graciles, 5 mm. longi. *Calycis* lobi 5, linearioblongi, glabri, 6 mm. longi. *Corollae* lobi viriduli, oblanceolati, calycis lobis latiores, paullo breviores. *Stamina* 10; filamenta gracilia, 3–4 mm. longa, basi incrassata et annulum formantia; antherae orbiculares, connectivo lato conspicuo. *Carpella* 5, ovoidea; styli extrorsum curvati; stigmata capitata; ovula 2. *Fructus* ignotus.

INDO-CHINA. Southern Shan States: Kengtawng; at Möng-Nai, trans-Salween, at about 700 m. altitude in old cultivation clearings, *W. A. Robertson* 285, March 1911.

722. **Campanula Robertsonii**, *Gamble* [Campanulaceae-Campanuleae]; *C. sylvaticae*, Wall., affinis, calycis lobis brevioribus, corollae lobis longioribus et foliis brevibus differt.

Herba perennis, ramulis floriferis permultis strictis gracilibus flexuosis albo-hirsutis, radice crassa lignosa. *Folia* alterna, membranacea, lineari-oblanceolata, apice acuta, basi attenuata,

sessilia, margine crenata, scabride albo-hirsuta, 1–1·5 cm. longa, 3–4 mm. lata, nervis utrinque 2–3 obscuris. *Flores* in paniculis paucifloris terminalibus subcorymbosis ; bracteae subulatae, 2–3 mm. longae ; pedicelli filiformes, 1·5–2 cm. longi. *Calycis* tubus turbinatus, albo-hirsutus, 3 mm. longus, conspicue nervosus ; lobi subulati, hirsuti, 2·5 mm. longi. *Corolla* campanulata, pallide caerulea, 7–8 mm. longa, ad mediam partem fissa, lobis acuminatis. *Stamina* 5, 3 mm. longa, antheris acuminatis et filamentis gracilibus basi paullo dilatatis. *Stylus* puberulus, 7 mm. longus, stigmatibus 3 recurvis. *Capsula* ovoidea, apice truncata, basi poris 5 rotundatis dehiscens. *Semina* ellipsoidea, laevia, minuta.

Indo-China. Southern Shan States : Kengtawng ; in crevices of limestone rocks on the banks of the Salween river, at about 200–250 m. altitude, *W. A. Robertson* 248, March 1911.

723. Taxotrophis triapiculata, *Gamble* [Urticaceae - Moreae] ; *T. javanicae*, Blume, affinis, foliis conspicue spinoso-serratis emarginatis mucronatis, emarginatura utroque latere spinosa et cum mucrone ideo triapiculata insignis.

Arbor parva, ramosissima, ramulis cinereis ultimis puberulis, stipulis novellorum acuminatis deciduis. *Folia* alterna, coriacea, glabra, ovata, apice emarginata, ob costam productam mucronata et ibi triapiculata, basi cuneata, marginibus cartilagineis conspicue spinosa-serratis raro integris, 4–9 cm. longa, 3–5 cm. lata, costa clavata, nervis utrinque 10–12 rectis parallelis prope marginem arcuatim junctis, nervulis intermediis multis etiam parallelis reticulatione conspicua ; petioli subcrassi, ad 5 mm. longi, juniores puberuli ; stipulae ovato-lanceolatae, brunneae. *Flores* dioici : ♂ in spicas sessiles axillares 1–2 cm. longas congesti ; rhachis carnosa ; bracteae obtusae, puberulae, ciliatae, 1·5 mm. longae, vix 2 mm. latae, flores 1–2 sessiles amplectentes ; perianthii lobi 4, ovati, hyalini, 1 mm. longi ; ♀ in racemis 1–3-floris axillaribus pedunculatis puberulis ; pedunculi circa 3–4 mm. longi, bracteolis parvis distantibus ; pedicelli 1 mm. longi ; perianthii lobi 4, crassi, 2 exteriores oppositi, 2 interioribus paullo longiores, omnes ovarium arcte amplectentes. *Stamina* 4, perianthii ♂ lobis opposita ; antherae orbiculares, introrsae ; filamenta 2 cm. longa, sub pistillo rudimentario 4-lobo affixa. *Ovarium* ovoideum ; stylus lateralis, brevissimus, cito in stigmata 2 subulata 2 mm. longa divisus ; ovulum unum, sub styli basi pendulum. *Fructus* non visus.

Indo-China. Southern Shan States : Kengtawng ; Möng-Nai, along streams in damp limestone gravel, 240 m., *W. A. Robertson* 254 to 257, March 1911. Cochinchina : Prov. Bien Hoa, "ad montem Lu, " *Pierre* 3281, March 1877.

724. Bomarea alpicola, *Kränzl.* [Amaryllidaceae-Alstroemerieae] ; *B. Caldasianae*, Herb., affinis, a qua differt partibus omnibus multo minoribus, pubescentia densiore, floribus vix ¼ illius speciei aequantibus.

Caulis (summitas tantum adest) valde tortus, satis dense pilosus, distanter foliatus. *Folia* brevissime (circiter 1 mm.) petiolata, oblonga, acuta, subcoriacea, valde nervosa, petiolo torto et facie infera folii dense pilosa, cum petiolo ad 2·2 cm. longa, 0·8–1 cm. lata. *Bracteae* numerosae, dense aggregatae, oblongae, utraque

facie dense pilosae, ad 1 cm. longae, pedicellos vix 1 cm. longos dense pilosos simplices ebracteolatos superantes, reflexae. *Flores* succedanei, vix 15 in umbellam parvam 2·5 cm. longam congesti, purpurei mihi visi sunt, ringentes, alabastris compluribus floribus interpositis. *Sepala* obovato-oblonga, glabra, apice obtusa, 1 cm. longa, circiter 3 mm. lata. *Petala* ex ungue angustissimo ciliato supra dimidium subito dilatata, subrhombea, 1·4 cm. longa, antice obtusangula, 6–7 mm. lata. *Ovarium* obconicum, dense pilosum.

Columbia. Fuquieres, 3000-3600 m. Received from Messrs. Sander and Sons, St. Albans, Herts.

The species is difficult to characterise. Technically it is near to *B. Caldasiana*, but it is of a much smaller size than even the most depauperated specimen of this species. Also the hairiness is everywhere denser except in the flowers which are glabrous but for a short portion of the claw of the petals. To judge from dried specimens of other species the colour of the flowers has not been yellow or orange but purplish. The plant described above may be the same as a specimen received from Sander and Sons, gathered at Pasto, and referred by Mr. J. G. Baker to *B. Caldasiana*.

725. **Bomarea calyculata**, *Kränzl.* [Amaryllidaceae-Alstroemerieae]; differt a *B. formosissima*, Griseb., cui similis, bracteis magnis numerosis calycem exteriorem formantibus et petalis apice non retusis sed breviter et obtuse acutatis.

Caulis certe altus, volubilis, ubique glaber, apicem usque foliatus. *Folia* ovato-oblonga, acuta vel acuminata, brevipetiolata (petiolis 5 mm. longis vix tortis), supra glabra, subtus sub lente valido in nervis minute pilosa, ad 9 cm. longa, ad 2·5 cm. lata; folia infrafloralia ad 12, dense congesta, caulinis simillima nisi minora, 6–7 cm. longa, 2 cm. lata. *Umbella* simplex, circiter 20-flora; pedicelli tenuissimi, simplices, glabri, circiter 2 cm. longi, quam flores manifeste breviores, haud bracteolis obsiti. *Flores* 4 cm. longi; sepala petalaque omnino aequilonga, glabra. *Sepala* obovato-lanceolata, apice obtusa, 4 cm. longa, 1 cm. lata. *Petala* a basi dimidium usque linearia, deinde rhombeo-spatulata, haud retusa, triangula, obtuse acutata, circiter 1 cm. lata. *Filamenta* tenuissima, glabra, perigonii phyllis vix breviora. *Ovarium* obconicum, profunde sulcatum, 3 mm. longum, glabrum.

Bolivia. *Pearce* 205. Presented by Messrs. Veitch 1884.

Mr. J. G. Baker is certainly right in comparing this plant with *B. formosissima*, Griseb., but it also shows strong resemblances to *B. superba*, Herb., being to a certain degree intermediate between the two species. It agrees with Mr. Herbert's plate of *B. superba* in the flower but has much larger and broader leaves. It also agrees fairly well with Mr. Baker's description of *B. superba* ("The Handbook of the Amaryllideae," p. 153) but differs in the absence of hairs especially in the flowers and inflorescence. It has the habit and compact inflorescences of *B. formosissima*, Griseb., the petals of which are, however, different.

726. **Bomarea foliolosa**, *Kränzl.* [Amaryllidaceae-Alstroemerieae]; *B. multiflorae*, Mirb., haud dissimilis, differt caule tenuiore, foliis parvis numerosis, floribus majoribus paucis.

Caulis volubilis, circiter 2·5 cm. diametro, in parte suprema 36 cm. longa glaber, foliis undique aequaliter vestitus. *Folia* parva,

brevipetiolata, subtus et supra glabra, subtus pallidiora, cum petiolo torto undulato 5 mm. longo ad 5·5 cm. longa, ovato-lanceolata, acuta vel acuminata, 1·5 cm. lata, suprema minora, inflorescentiam fere attingentia. *Bracteae* crebrae, lanceolatae, acutae, reflexae, subtus minute puberulae, 2 cm. longae ; pedicelli ad 10, simplices, haud bracteolati, breviter denseque puberuli, 1·5 cm. longi, quam flores bene breviores. *Flores* vix penduli, purpurei esse videntur. *Sepala* ligulata vel anguste lineari-oblonga, obtusa, extra praesertim apice brevipilosa, 2·5 cm. longa, 4 mm. lata. *Petala* aequilonga, ex ungue lineari-canaliculato piloso spatulata, antice rotundata, medio apiculata. *Filamenta* dimidium usque brevipilosa quam phylla paululum breviora. *Ovarium* subsemiglobosum, dense puberulum.

Colombia. Near Bogota, flowering in October, *Holton* 146.

The plant shows some resemblance to *B. multiflora*, Mirb. (a rather badly defined species), but the sepals and petals are of exactly the same length and the number of flowers is very limited. It should be placed among the small species. It also shows some superficial resemblance to *B. acutifolia*, Herb., but this has leaves less than one third of the length and still fewer flowers.

727. **Bomarea Mooreana**, *Kränzl.* [Amaryllidaceae-Alstroemeriae] ; nulli affinior, differt ab omnibus statura parva, caule superne aphyllo ceterum folioso, floribus angustis fere tubulosis.

Caulis volubilis, tenuis, glaber, crassiusculus ; pars quae praestat, circiter 30 cm. longa, superne per 11 cm. aphylla, squamulis 1 vel 2 praedita, ceterum foliis 25–30 parvis obsita. *Folia* brevipetiolata, lanceolata vel ovato-lanceolata, longe acuminata, membranacea, griseo-viridia (viva glaucescentia?) supra glabra, subtus praesertim in nervis dense pilosa, cum petiolo torto 5 mm. longo utplurimum 7 cm. longa, 1·5 cm. lata ; bracteae inflorescentiae minutae, externae lineares, internae filiformes ; pedunculi circiter 6, tenues, 5–7 cm. longi, 1–3–flori, glabri, bracteolis parvis obsiti ; pedicelli denique filiformes, partim necnon ovaria sepalaque dense vel praesertim in alabastris densissime pilosa. *Flores* phyllis omnibus arcte conniventibus parallelis, tubulosi, penduli. *Sepala* ligulata, obtusa, antice paululum latiora, pulchre reticulata, 1·8 mm. longa, 4 mm. lata. *Petala* subpandurata, infra dimidium leviter contracta, apicem versus spatulata, sensim dilatata, apice obtuse acutata, basin versus haud multum angustiora, linea dorsali dense villosa a basi apicem usque instructa, 2·2 cm. longa, antice 6 mm. lata. *Stamina* longa ; antherae petala exedentes ; stylus multo brevior.

Origin unknown. It flowered at Glasnevin in 1908. This is the smallest species of *Bomarea* yet described and stands in marked contrast to its larger congeners. The petals being clearly longer than the sepals and the pedicels being much branched, the species belongs to Mr. Baker's last section which contains only four species all without exception very large plants. The flowers are white in the dry state suffused with rose at the tips and have anastomosing rose veins.

728. **Zephyranthes filifolia**, *Kränzl.* (descr.) ; *Herb.*, ex *Baker*, Handbook of Amaryllideae, 1888, p. 33 (nomen). [Amaryllidaceae-Amaryllideae] ; a *Z. depauperata*, Herb., statura minore, foliis omnino

capillaceis (nec linearibus), pedunculo crassiusculo satis firmo, pedicello vaginaque brevioribus, perigonii segmentis lanceolatis usque oblongis recedit.

Bulbi non visi; pars inferior caulis cataphyllis paucis brunneis vestita. *Folia* filiformia vel potius capillacea, ad 10 cm. longa, vix 0·5 mm. lata. *Scapus* sine flore ad 8 cm. altus, crassiusculus, medio interdum leviter incrassatus (semper ?), in apice ipso paululum dilatatus, semper (certe in speciminibus 12 visis) monanthus. *Vagina* pedicellum et ovarium necnon partem basilarem perigonii includens, pellucida, tenuiter pergamacea, acuminata, 2·2 cm. 'onga; pedicellus circiter 1 cm. longus. *Flores* lutei, illis *Gageae pratensis* nostrae subsimiles. *Perigonii* tubus brevissimus, vix 2 mm. longus. *Sepala* lanceolata, acuta, 1·8–2 cm. longa, 3 mm. lata. *Petala* oblongo-lanceolata, aequilonga, acuta, 1·8–2 cm. longa, 5–6 mm. lata. *Stamina* fundo tubi inserta, 4 mm. longa. *Ovarium* 7 mm. longum, 4 mm. crassum; stigmata 3, valde torta.

Patagonia. Found in gravel, sand and clay, *W. Andrews*.

Mr. J. G. Baker in his "Handbook of the Amaryllideae" p. 33, says that the specimens of this plant agree in all characters, except the size, with a drawing of Mr. W. Herbert's inscribed *Z. filifolia*, and on the sheet to which the specimens are glued is a short note in Mr. Baker's handwriting to the same effect. Although the name until now was a nomen nudum I have accepted it and publish here a diagnosis.

729. **Collania Jamesoniana**, *Kränzl.* [Amaryllidaceae-Amaryllideae]; *C. andinamascanae*, Herb., proxima, a qua floribus bene minoribus, foliis brevioribus et ab omnibus adhuc descriptis bracteolis in ipsa basi pedicellorum differt.

Caulis summitas tantum adest 12 cm. longa, glabra, profunde sulcata, satis dense foliata. *Folia* 1·8 cm. inter se distantia, patentia vel deflexa, crasse coriacea, rigida, in alterum latus versa vel torta, lineari-oblonga, brevi-acutata, margine revoluta, supra et subtus glabra, 5 cm. longa, circiter 7 mm. lata, suprema dense congesta, breviora latioraque, 3–4 cm. longa, ad 1 cm. lata, reflexa. *Inflorescentia tota* umbellata, cum parte suprema caulis subnutans, minime deflexa, circiter 10-flora; bracteae tenues, oblongae, coloratae (?), 6–8 mm. longae, quam pedicelli simplices torti glabri 2·5 cm. longi multo breviores. *Flores* succedanei; perigonii phylla aequilonga, 3·2 cm. longa, extra glabra, ut videtur rubra, apicibus rubris. *Sepala* late oblonga, breviter et obtuse acutata, 3 cm. longa, 9 mm. lata. *Petala* basi angusta haud vel vix canaliculata sensim dilatata, cuneata, antice obtusangula, leviter crenulata, apiculata, 1 cm. lata. *Stamina* paulo tantum breviora. *Ovarium* obconicum, glabrum.

Ecuador. *Jameson* 164.

This species resembles at first sight the drawing of *C. andinamascana*, Herb., in his work on the Amaryllidaceae, plate 8, but the flowers are a good deal smaller and there are real bracts at the base of the flower stalks, a character never before observed in *Collania*. The leaves also are nearly blunt and not acuminate as in *C. andinamascana*.

730. **Crinum Stapfianum**, *Kränzl.* [Amaryllidaceae-Amaryllideae]; a *C. podophyllo*, Baker, cui habitu et magnitudine florum haud

dissimile, floribus longe pedicellatis floribusque in tertia tantum parte basilari in tubum connatis recedit.

Bulbi globosi, 8 cm. diametro, in collum 5–6 cm. longum 3 cm. crassum producti. *Folia* desunt. *Pedunculus* ut videtur anceps, certe compressus, 20–30 cm. altus, in speciminibus omnibus (4), quae examinavi, biflorus, spatha sub anthesi basin usque bipartita, parte utraque triangulari ad 5 cm. longa; bracteae florales tenerrimae, lineares, pedicellos florum 4–6 cm. longos basi saepius valde incrassatos longe non aequantes. *Perigonium* ad 12 cm. longum, infundibuliforme, in orificio 4 cm. diametro, certe album; tubus tertiam circiter partem totius aequans, deinde divisus, segmentis sensim divergentibus. *Sepala petalaque* subaequilonga, lanceolato-obovata, petala sublatiora, teneriora, omnia acuta. *Stamina* 4–5 cm. longa, orificium floris non attingentia. *Ovarium* breve, ellipsoideum vel elongato-obovatum, 1·2 ad 1·5 cm. longum. *Stylum* non vidi.

Brazil. Chiefly Province of Goyaz, *Glaziou* 22,204.

This species of which I have seen four specimens resembles at first sight *C. americanum*, L. or *C. erubescens*, Ait., both of which are known for their tendency to vary in all parts. It has also a certain resemblance, especially in its two flowered inflorescences to *C. podophyllum*, Baker. The most striking feature and one by which it can be distinguished from all other species is the long flower-stalk, which is 5 to 6 cm. (2¼ inches) in length. The tube of the flower is comparatively short, surely shorter than in the three species quoted above. It is divided into six segments from a little above the basal third, the segments diverging gradually to form a rather narrow funnel. The colour is undoubtedly white.

XXXI.—MISCELLANEOUS NOTES.

Gift of Orchids by Sir George Holford.—The Kew collection of orchids has recently been greatly enriched by the gift of about 150 large plants of Cattleya, Laelia, Laelio-Cattleya, Brasso-Cattleya, Cymbidium and Cypripedium by Lt.-Col. Sir George Holford, from his famous collection at Westonbirt. While the collection of orchids cultivated at Kew must be essentially botanical, its main object being to represent the family in as comprehensive a way as possible, the great progress made in recent years in the breeding of hybrids, many of which are botanically interesting as well as possessed of exceptional claims as garden plants, necessitated the addition of a selection of them to the collection. Increased accommodation was provided last year by the erection of an intermediate house adjoining the T Range, and, thanks to Sir George's generosity, Kew now possesses some of the best of the Cattleyoid hybrids.

Resting Spores of Phytophthora infestans.—The question of the production of oospores by the Potato Blight fungus, *Phytophthora infestans*, has long been the subject of investigation. Though the

presence of resting spores in the diseased tissues of the potato plant has been recorded by various writers, the connection of these bodies with *Phytophthora* was more than doubtful, and owing to the difficulty of cultivating the fungus as a saprophyte investigators were unable to check the point by the pure-culture method.

During the last decade considerable advance has been made in the successful artificial cultivation of *P. infestans*, workers both on the continent and in America having succeeded in preparing media on which it grows readily as a saprophyte. Conidia were obtainable in abundance, but in most cases no traces of sexual organs or oospores could be discovered. In 1911, however, Clinton recorded the production of oospores in a medium derived from oats (oat-juice agar), and noted also the presence of antheridia and oogonia. Corroboration of this discovery was highly desirable, and the matter was taken in hand the same year by Pethybridge and Murphy at the Clifden Experiment Station in Ireland. Their report on the subject is now published.* It contains an account of pure cultures on various substrata, and of the production of sexual organs and oospores on a special oat medium. Clinton's results are fully confirmed, and some new points, especially with regard to the development of the spores, are brought to light.

The medium on which antheridia and oogonia were induced to form was ground Quaker Oats agar. On this the fungus grows vigorously, and after producing a luxuriant crop of conidia develops oospores readily and freely. The oospores arise as the result of the apparent fertilization of the oogonia by antheridia, their development following the process described by Pethybridge for *P. erythroseptica*. The spores measure 28–30μ in diameter, and the wall is 2–4μ thick. On Clinton's oat-juice agar oospores were produced parthenogenetically in the absence of antheridia, and the same phenomenon also took place to a large extent in the Quaker Oats cultures. In the case of the latter the authors believe that the formation of antheridia is a matter of time, and that with prolonged culture these bodies will invariably appear. Clinton found that in the absence of antheridia, the oogonia did not develop further than the oosphere stage, but in the Irish cultures many of the oogonia undoubtedly produced thick-walled, parthenogenetic oospores.

Every precaution was taken by Pethybridge and Murphy to exclude foreign organisms, and there can now be no doubt whatever that *P. infestans* is capable of forming antheridia and oogonia from which resting spores arise. The important question as to whether the fungus produces oospores in *Solanum* is one to be settled by further research, but now that the spores are known and described, it will be possible to compare with them the various thick-walled spores known to occur in different parts of the diseased potato plant.

A. D. C.

---

* On Pure Cultures of Phytophthora infestans, De Bary, and the Development of Oospores. By G. H. Pethybridge and Paul A. Murphy. Sci. Proc. Roy. Dublin Soc., vol. xiii, No. 36, March 1913, pp. 566–588.

Copal from the Congo.—In a recently issued Diplomatic and Consular Report on the Trade and Resources of the Congo for the year 1911, Mr. Consul Lamont gives the following particulars of the industry and of the export trade in this product which has developed considerably during the year :—"The resin is derived in the Congo from *Copaifera Demeusei* and other trees of the leguminous family. It is found principally in the marshy forests bordering the rivers in the districts of Lake Leopold II., Bangala, Equateur, Ubangi, Moyen Congo, Kasai, Stanleyville and Aruwimi that is in the base formerly occupied by the inland sea. Two kinds of gum are found: Fresh copal is collected from the trees and fossil copal dug up from trees that have sunk in decay under the soil. The natives search round the bases of copal-bearing trees with sticks tipped with iron and find it in large quantities. At low water, too, on the sandy river reaches they often find copal. Before exportation it is divided into parcels hard and soft; the former is treated with a solution of caustic soda of 1 per cent. strength for half an hour and is then washed in water and dried in the sun. The softer copals of whitish or yellow texture are of recent formation and are simply scraped before packing; exposed to the air for a certain time they become clearer and harder. The copal of the Congo is classified on the Antwerp market under five heads :—(1) sorted white best quality; (2) sorted clear, transparent; (3) assorted, less transparent; (4) somewhat opaque; (5) not sorted. The exports during the last eight years are as follows :—

	Metric Tons.
1904	938·6
1905	754
1906	912·3
1907	1,060·3
1908	1,618·9
1909	826·5
1910	975·5
1911	2,138·8

The price at Antwerp varies from 6*d.* to 1*s.* 3*d.* per lb.

The natives only use copal for illuminating purposes; in Europe it enters largely into the manufacture of varnishes, the most valuable copals for that purpose being hard and transparent and fracture like glass. The shades of colour are important, as the colour of the varnish depends on them."

De Cordemoy in Ann. L'Inst. Col. Marseille VI., fasc. 2, 1899, p. 251, states that throughout the Congo region more or less copal is collected consisting of two varieties namely, red and white, and that the red form is without doubt afforded by *Copaifera Mopane*, described as a fine forest tree of Lower Guinea and the Mozambique District. The wood is extremely hard, dark, heavy and durable but difficult to work and is known as Iron-wood in the Zambesi. The seeds are reniform or oblong with large resinous glands, easily discernible with the naked eye. J.M.H.

1
3
4
2
5
6
12
9
7
8
13
10
11
20
16
19
17
20×
14
15
18